Exploring the potential of trans fats policies to reduce socio-economic inequalities in coronary heart disease mortality in England

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Talk outline

- Trans fats
- Modelling Health outcomes
- Modelling cost effectiveness
- Comparing trans fats policies

Coronary Heart Disease

- **Huge burden of disease**
- **↓Mortality rates, halved over two decades**
- **BUT Inequalities persisted & even worsened**
- **50% mortality fall due to risk factor reductions**
- **Major Risk Factors:**
  - **Diet: Trans Fats, Salt, Sugar, Sat Fat, Fruit & Veg**
  - **Tobacco**
  - **Excess Alcohol**
  - **Physical Inactivity**

Bajekal et al Plos Med 2012

Coronary Heart Disease

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Bajekal et al Plos Med 2012

Dietary Trans Fats

- **Hydrogenated vegetable oils**
- **↑CHD risk more than any other macronutrient**
- **↑ 1%$_E$ in daily energy intake ↑CHD mortality 12%**
- **UK – 'voluntary regulation' & 'better labelling'**
  - **Intake halved 1.4% ↓ 0.7% daily energy**
  - **BUT socio-economic gradients in intake**

Mozzafarian et al. N Engl J Med. 2006;354(15):1601-13

National Diet and Nutrition Survey published May 2014

Trans fats Policy - UK

- **UK – ‘voluntary regulation’**
  - **Intake halved over past 10 years**
  - **Later absorbed into Responsibility Deal**

Global Trans Fats Policies

(summary)

- **Full legislative bans**
  - **Denmark (2004), Austria & Switzerland (2009)**
  - **Iceland (2010), Hungary & Norway (2014)**
  - **USA** (Labelling from 2008, GRAS* from 2015)
- **Partial Ban**
  - **NYC (2008), voluntary then mandatory**
- **Labelling**
  - **Brazil (2003)**

**no longer recognised as GRAS (Generally Recognised As Safe)*

- **What are the potential health benefits of reducing dietary Trans Fats consumption in the UK?**

Methods

- Population level reduction in TF intake by 1% and 0.5%
- Modelling approach
- Mortality counterfactuals
- Beta coefficient for risk factor intervention
- Stratified by age, gender, SEC
  - First modelling equal TF intake
  - Second modelling unequal TF intake

Methods II

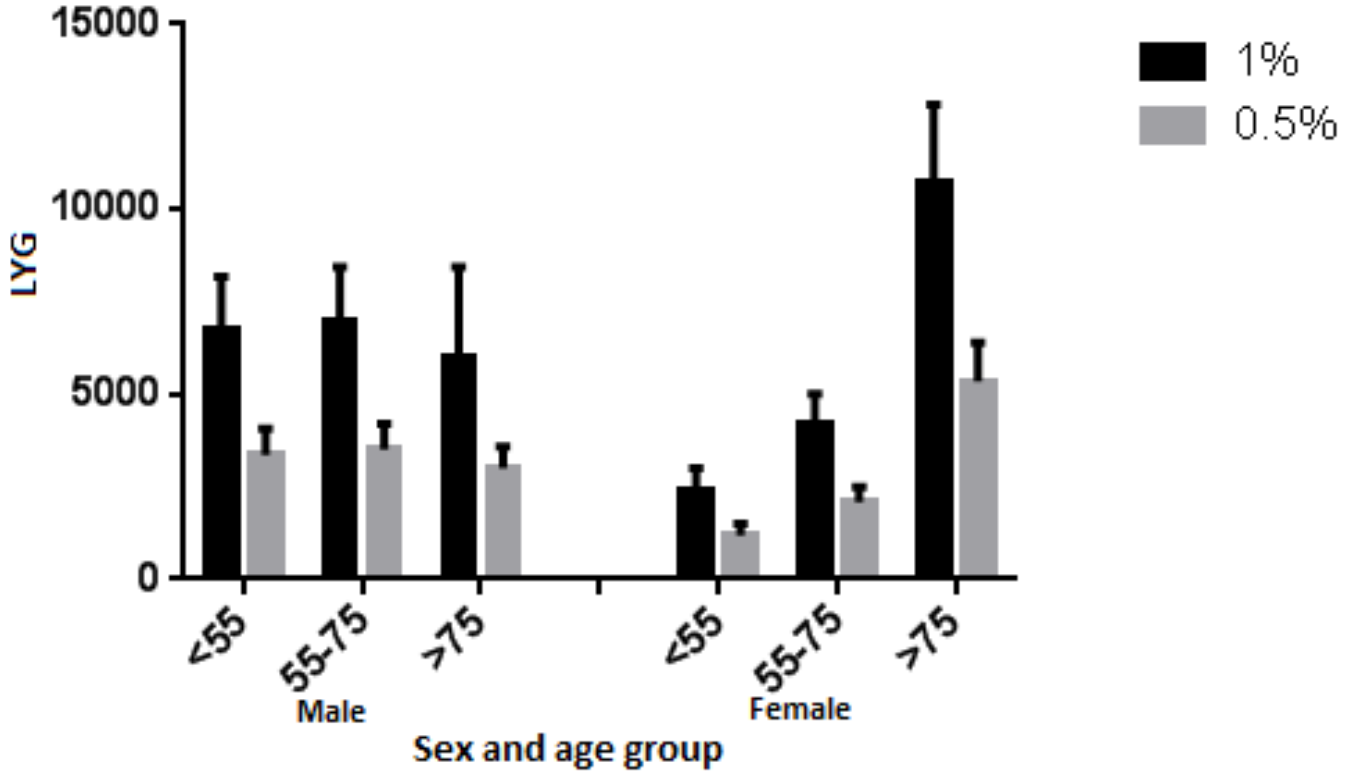
- Outputs:
  - Deaths prevented or postponed
  - Life Years Gained
  - Hospital Admissions
- Results tested in Probability Sensitivity Analysis

Results

- 1% reduction in TF consumption:
  - 3,900 DPPs
  - 42,000 LYGs
  - 10,000 Fewer Hospital Admissions

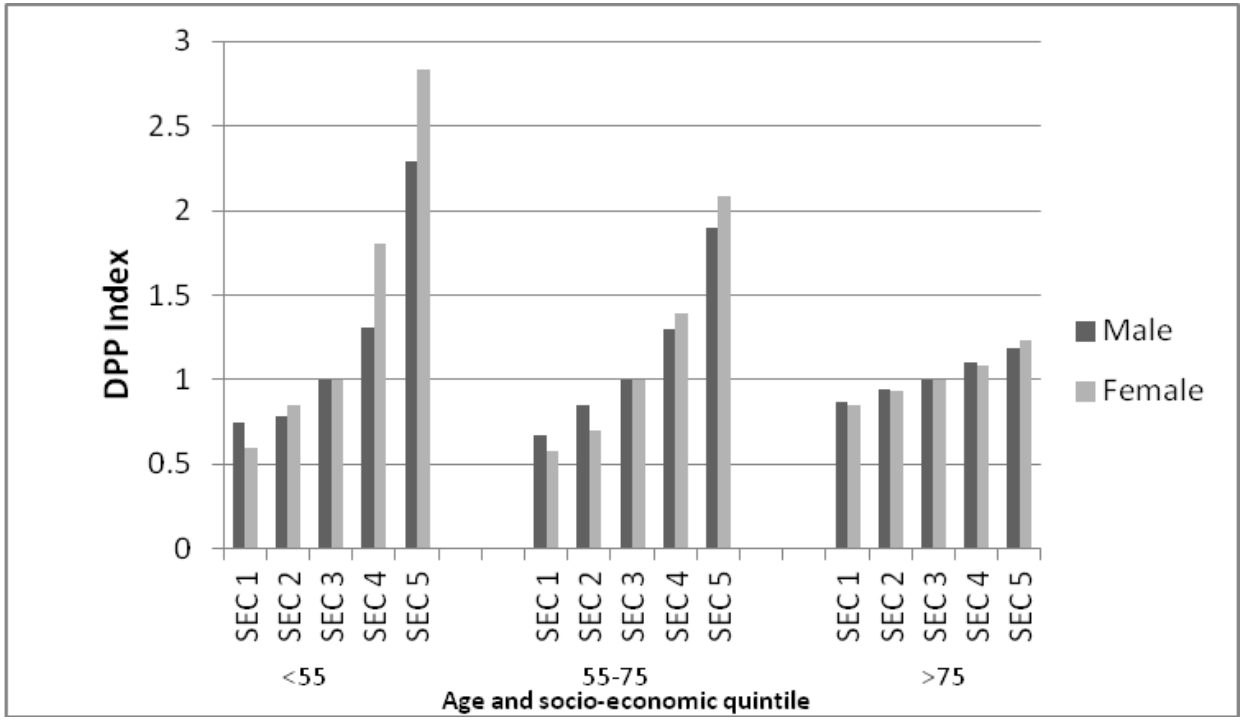
  - Per year!
  - 0.5% reduction still yields large health gains

Life Years Gained



Life years gained (LYG) with a 1% and 0.5% reduction in daily energy intake of trans fats. Life years gained (LYG) by age and sex

Would a reduction in TF consumption Affect Inequalities?



- DPPs Index with a 1% reduction in daily energy intake of trans fats intake. DPPs by age, gender and socio-economic circumstance assuming **equal** TF intake.

Pearson-Stuttard et al. PLoS One, Aug 2015

Would a ban on Trans Fats be cost effective?

- Estimated the population benefits, and cost effectiveness from 2011-2020 of:
  - Legislative ban on TFA (0% intake)
  - Mandatory reformulation (0.4% intake)
    - First modelling equal TF intake
    - Second modelling unequal TF intake
- Modelling approach
- Mortality counterfactuals
- Beta coefficient for risk factor intervention
- Stratified by age, gender, SEC

Methods: Costs

- Govt costs - Initial legislation + Annual monitoring
- Industry costs – reformulation + annual cost
- **Savings:**
  - Direct healthcare savings – reduction in hospital admissions
  - Informal care savings
  - Averted productivity loss
- All outputs discounted at 3.5%

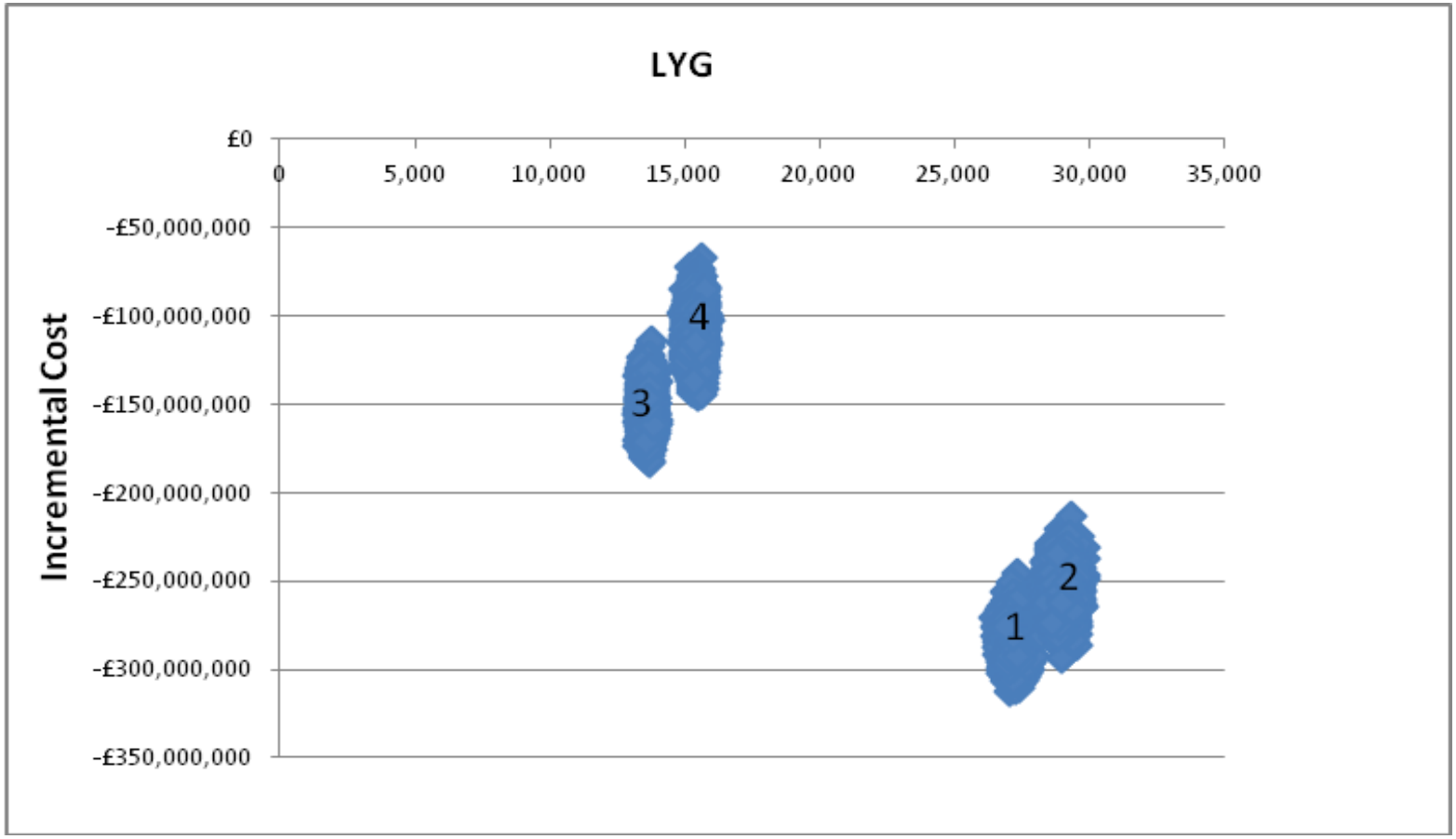
Results

- Legislative ban:
  - 27,200-29,000 life years
  - 17,700-19,300 QALYs
  - 68,000-72,000 hospital admissions averted
- Costs:
  - Govt: £22m - £27.2m
  - Industry: £0- - £140m

Cost effective?

- Cost effective:
  - Cost saving + QALYs = dominant scenario
  - £1,400-£1,600/LYG (conservative cost only)
    - Statins £27,000/LYG 1° prevention
  - $0.7 - $7 per capita (PPP)
    - WHO '**extremely cost effective**' < 1 x GDP per capita = $16,000 PPP

Cost effectiveness plane



Cost effectiveness of a legislative ban (1&2) or mandatory reformulation (3&4) on TFA, with equal (1&3) and unequal (2&4) intake across SEC quintiles.

- **Exploring the potential of trans fats policies to reduce socio-economic inequalities in coronary heart disease mortality in England : A cost-effectiveness modelling study**

Methods

- **Estimated population benefits, & cost effectiveness from 2015-2020 of:**
  - **Legislative ban on TFA**
  - **Partial ban – restaurants**
  - **Partial ban – fast-food**
  - **Improved labelling**
- **Outputs**
  - **Deaths prevented or postponed (DPP)**
  - **Quality Adjusted Life Years**
  - **CHD subgroup 'utility values'**

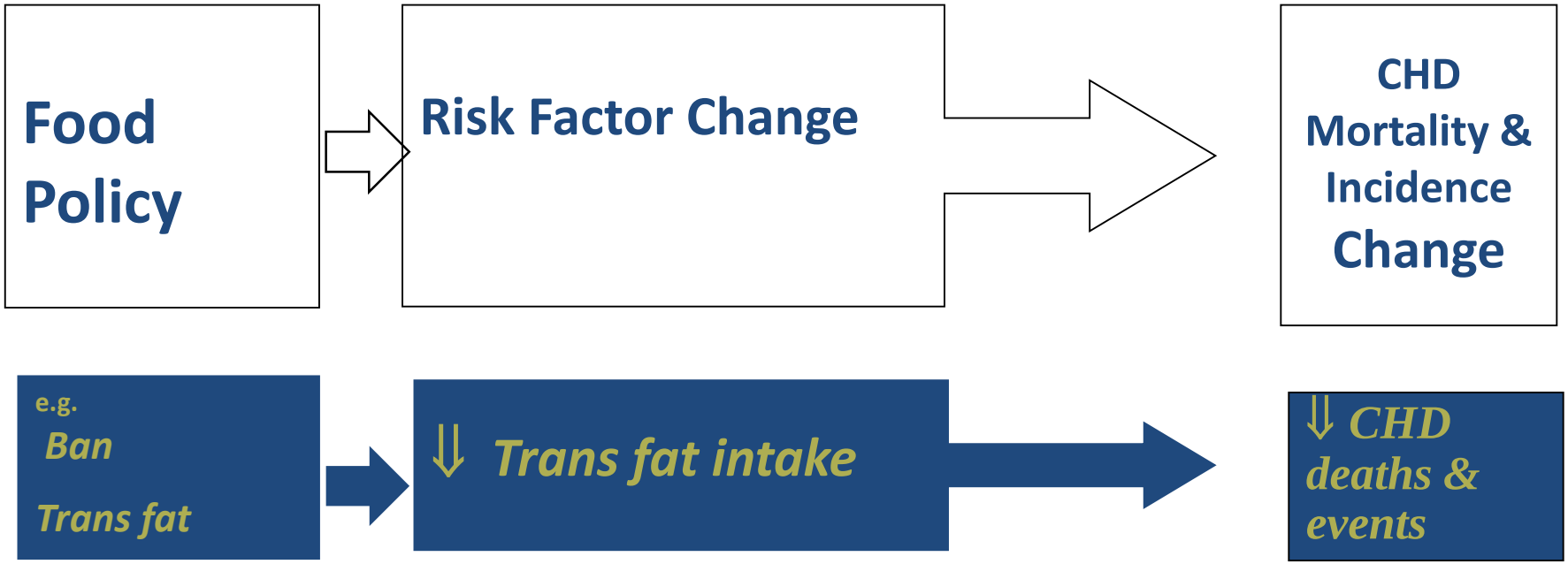
Socio-economic inequalities

- **Stratified by age & gender**
  - **Socio-economic circumstance**

    (Index Multiple Deprivation IMD) quintiles

- **Slope index**
  - **'absolute inequalities' in mortality across SEC quintiles**

Trans Fats Modelling Approach



Stratified by Socioeconomic Circumstance

Trans Fats in England

- **Average consumption approx. 0.7% Energy**
  - **National Diet & Nutrition Survey**
    - **≈ 0.3%E from industrial trans fats**
    - **≈ 0.4%E from ruminants (ie. meat & dairy products)**

- **Lower SEC groups probably higher consumption**

(Low Income Diet & Nutrition Survey)

	High SEC	SEC2	SEC3	SEC4	Low SEC
TF %E	**0.5 %**	**0.6 %**	**0.7 %**	**0.95 %**	**1.2 %**
Resulting TF%E	*0.4 %*	*0.4 %*	*0.4 %*	*0.4 %*	*0.4 %*

Methods: Costs

- **Government costs = Initial legislation + Annual monitoring**
- **Industry costs = reformulation + annual costs**
- **Savings**
  - **Direct healthcare savings & reductions in hospital admissions**
  - **Informal care savings**
  - **Averted productivity loss – 'frictional period'**

- **All outputs discounted at 3.5%**

Uncertainty

- **Probabilistic Sensitivity Analysis**
- **Assume statistical distribution for key parameters**
- **10,000 simulations**
  - **Computation time not a problem (~minutes)**
  - **Memory limitation (≤4GB can be a problem)**
- **Report 95% confidence intervals**

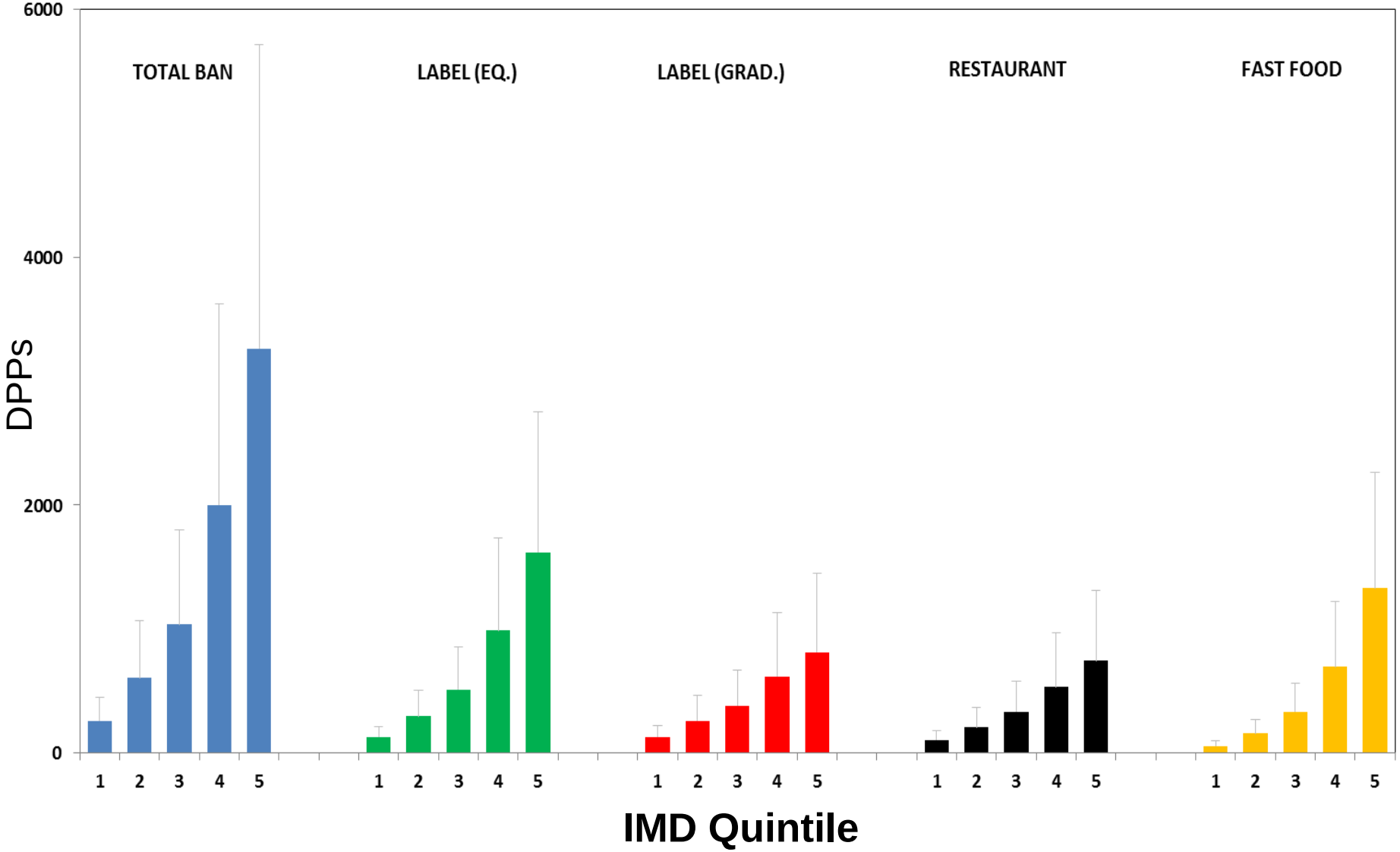
Results

- **Mortality -Deaths Prevented or Postponed (DPPs)**
  - **Total Ban 7,200** (↓2.5%)
  - **Labelling 3,500-2,200**
  - **Fast food 2,600**
  - **Restaurant 1,800**
- **CHD inequalities decreased**

  ↓ 3000 total ban (↓ 15%)

  ↓ 600, restaurant ban (↓ 3%)

Results – Deaths Prevented or Postponed (DPPs)



Costs

- **State costs:**
  - **£5m implementation + £2.4m annual monitoring**
    - **£21.6m over 5 year period**
- **Industry costs:**
  - **Worst case:**
    - **£25,000 per product, altering 8,000 product lines**
    - **£200m**
  - **Best case:**
    - **Reformulation absorbed in natural product Reformulation cycle**
    - **£0**

Savings

- **Direct Healthcare:**

  £42m (ban)

  £11m (partial ban – restaurant)

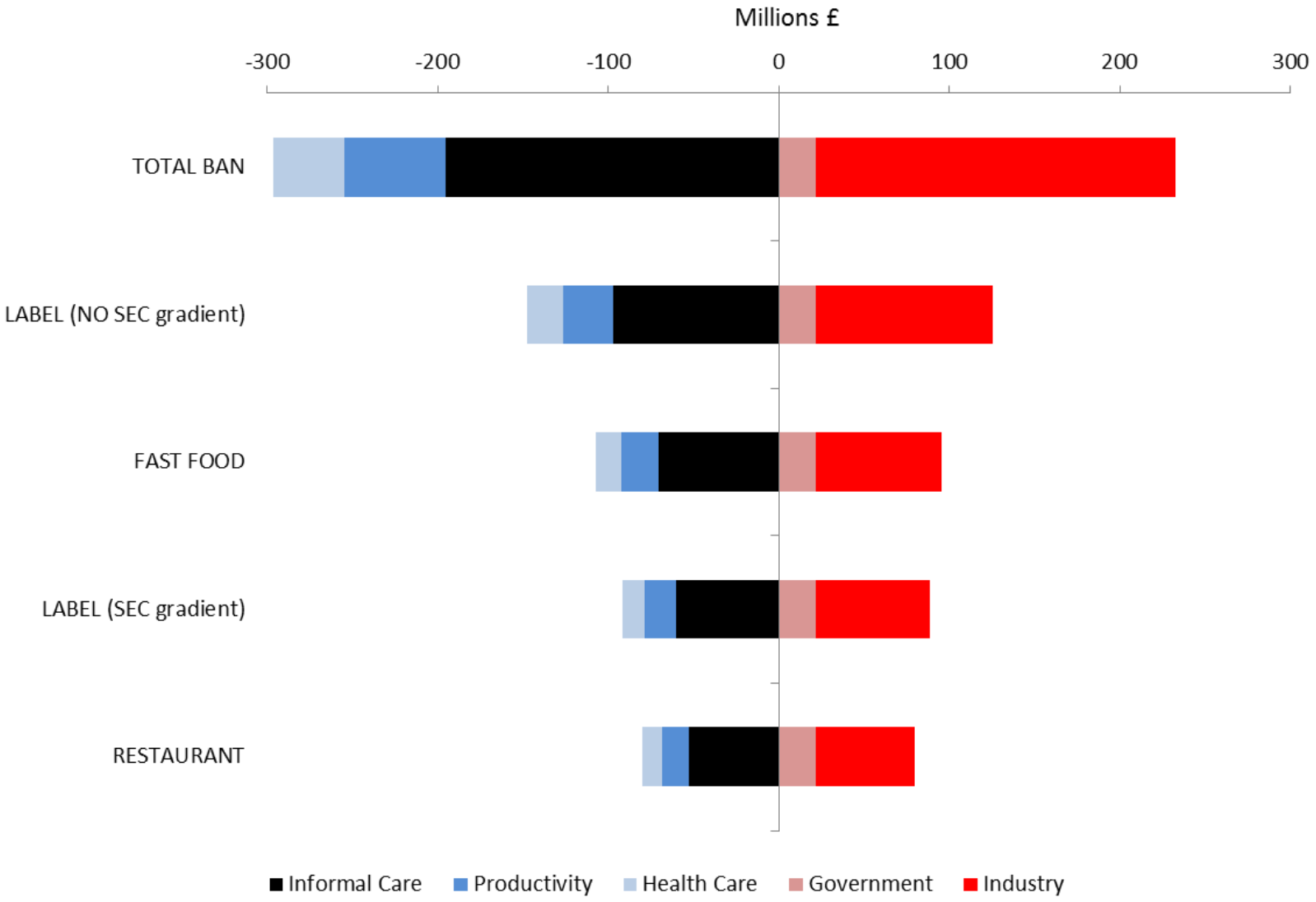
- **Informal Care:**

  £53m to £196m

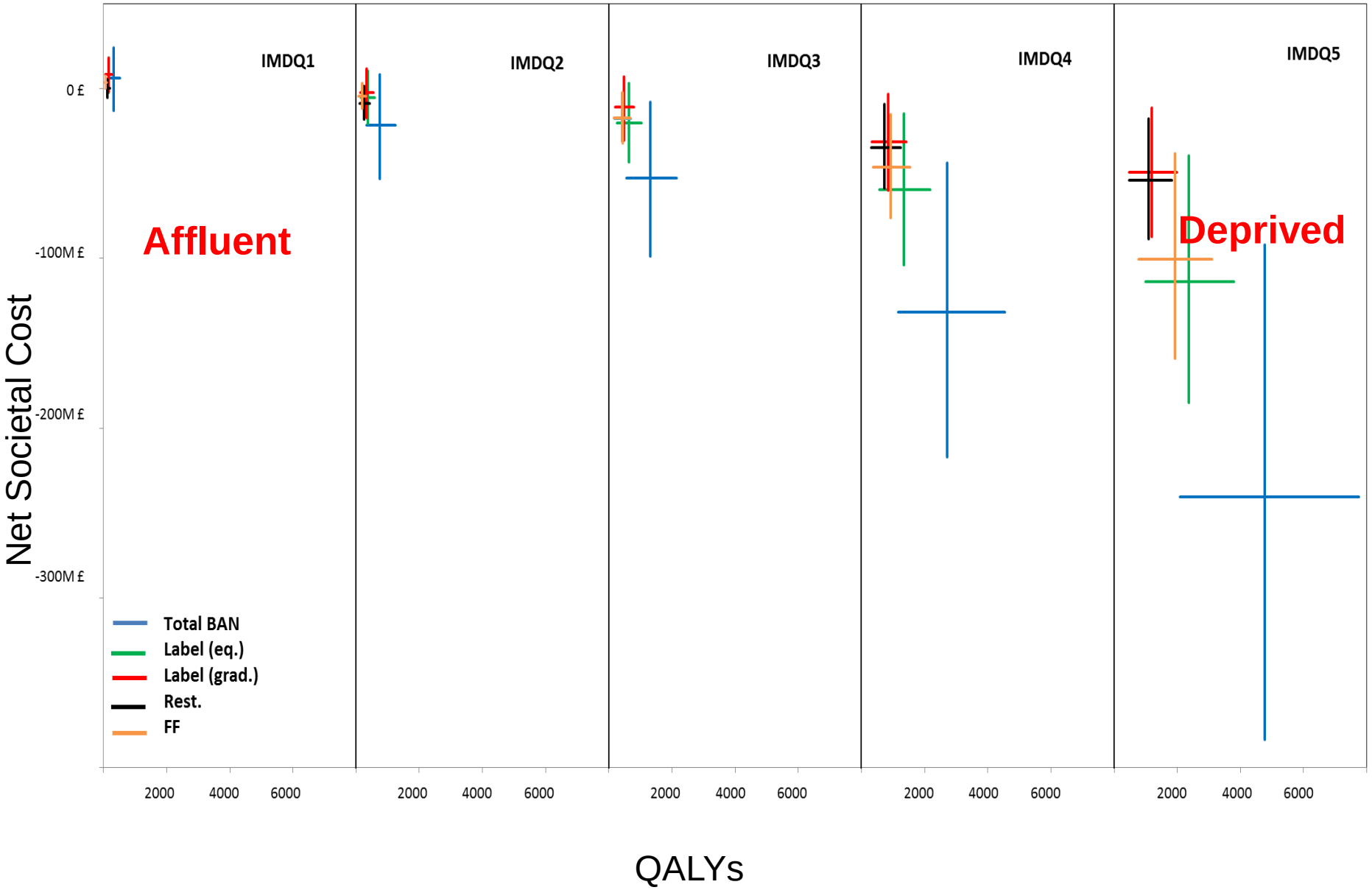
- **Averted Productivity Loss**

  £16m to £59m

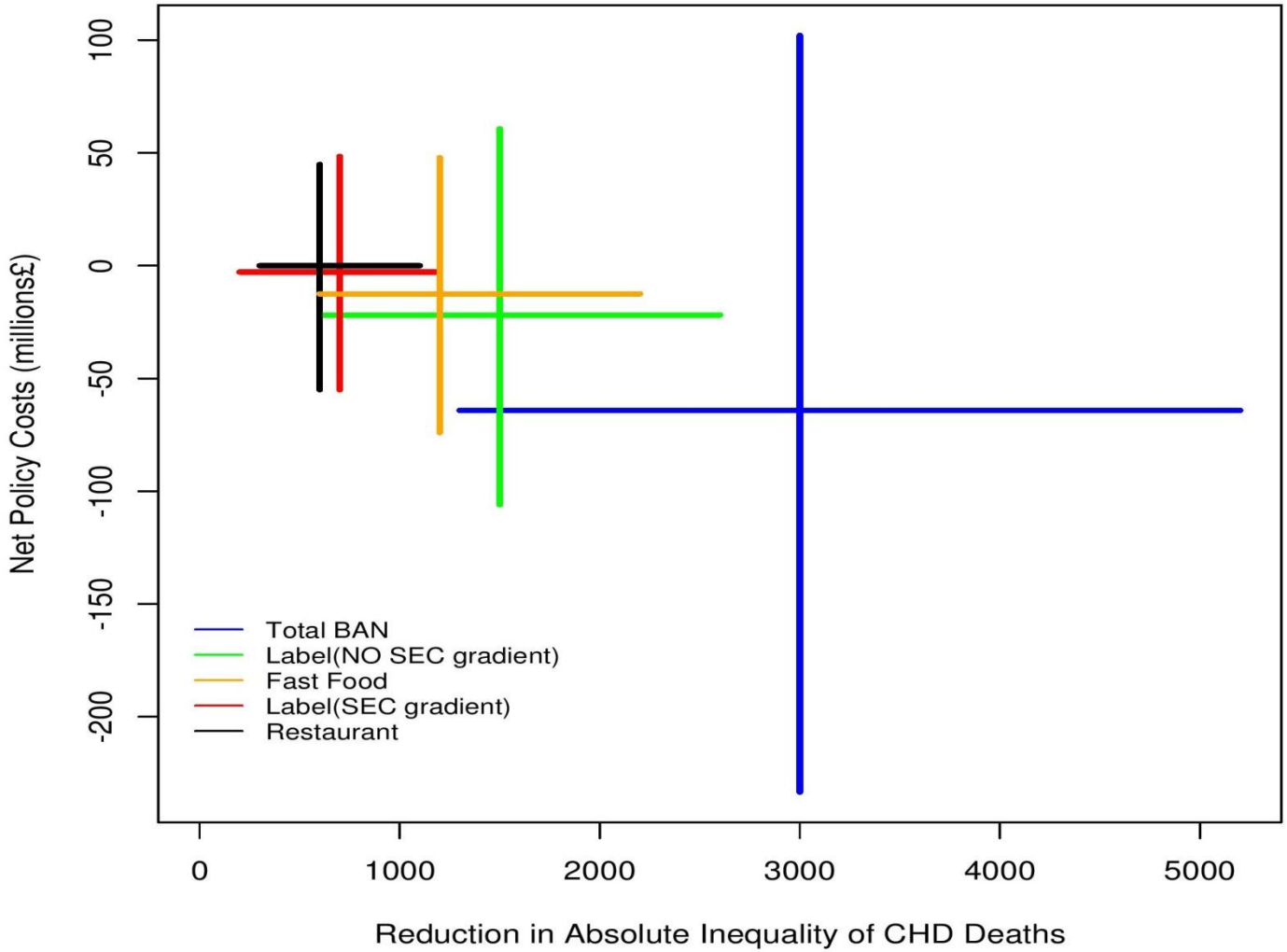
Savings & Costs



Results – All Cost-effective or cost-saving



Does ↓ TFA consumption ↓ Inequalities?



Study strengths

- **Results consistent with previous estimates**
- **Considers entire adult population**
- **Reliable datasets**
- **Novel modelling & stratification of population level interventions**
- **Use of APC mortality projections – may produce conservative estimates of mortality gains**

Limitations

BUT

- **Area level SEC categorisation**
- **Assumes instantaneous effect**
- **Ruminant TFAs Harmless? Unchanged?**
- **Effective implementation strategies?**

Why Tackle Trans fats?

- **Key part of dietary policies to ↓CHD**
- **‘Low hanging fruit’ in prevention policies**
- **Substantial reductions in inequalities**

Conclusions

- **All policies evaluated would reduce CHD mortality**
- **And be cost effective**
- **A legislative ban would be the most effective and equitable policy**
  - **CHD mortality ↓ 2.5%**
  - **↓14% CHD mortality inequalities**
  - **Savings £15,000 per QALY**

Acknowledgements

- Will Hooton
  - University of Oxford
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  - St George's, University of London
- Kirk, Allen, Martin O'Flaherty & Simon Capewell
  - University of Liverpool

Thank you

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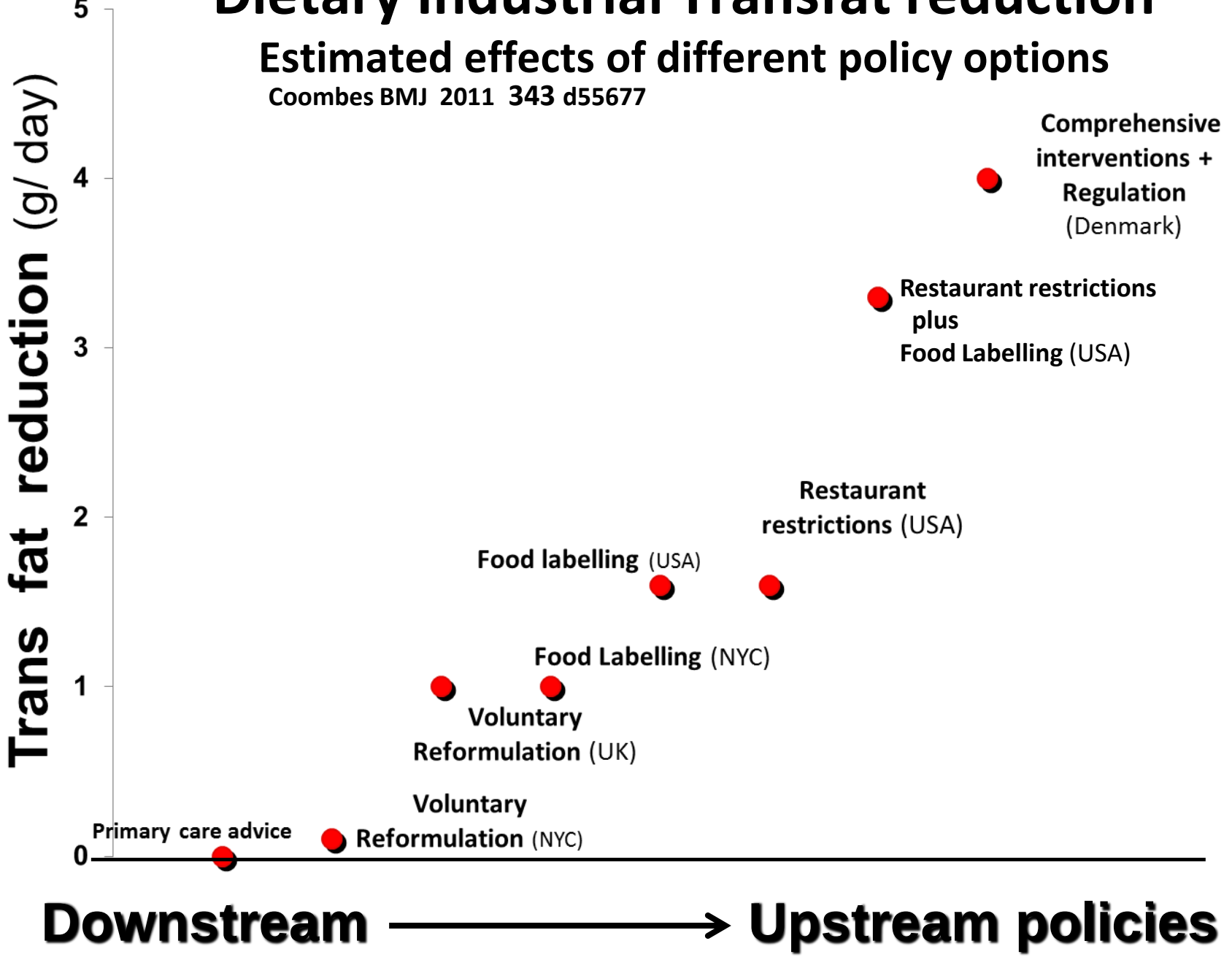
Reserve Slides

Dietary Industrial Transfat reduction

Estimated effects of different policy options

Coombes BMJ 2011 343 d55677



Responsibility Deal (RD)

- Public-private partnership
- Voluntary agreement
- **Food**, alcohol, physical activity, health at work
- Signatories report progress each spring

RD - Food

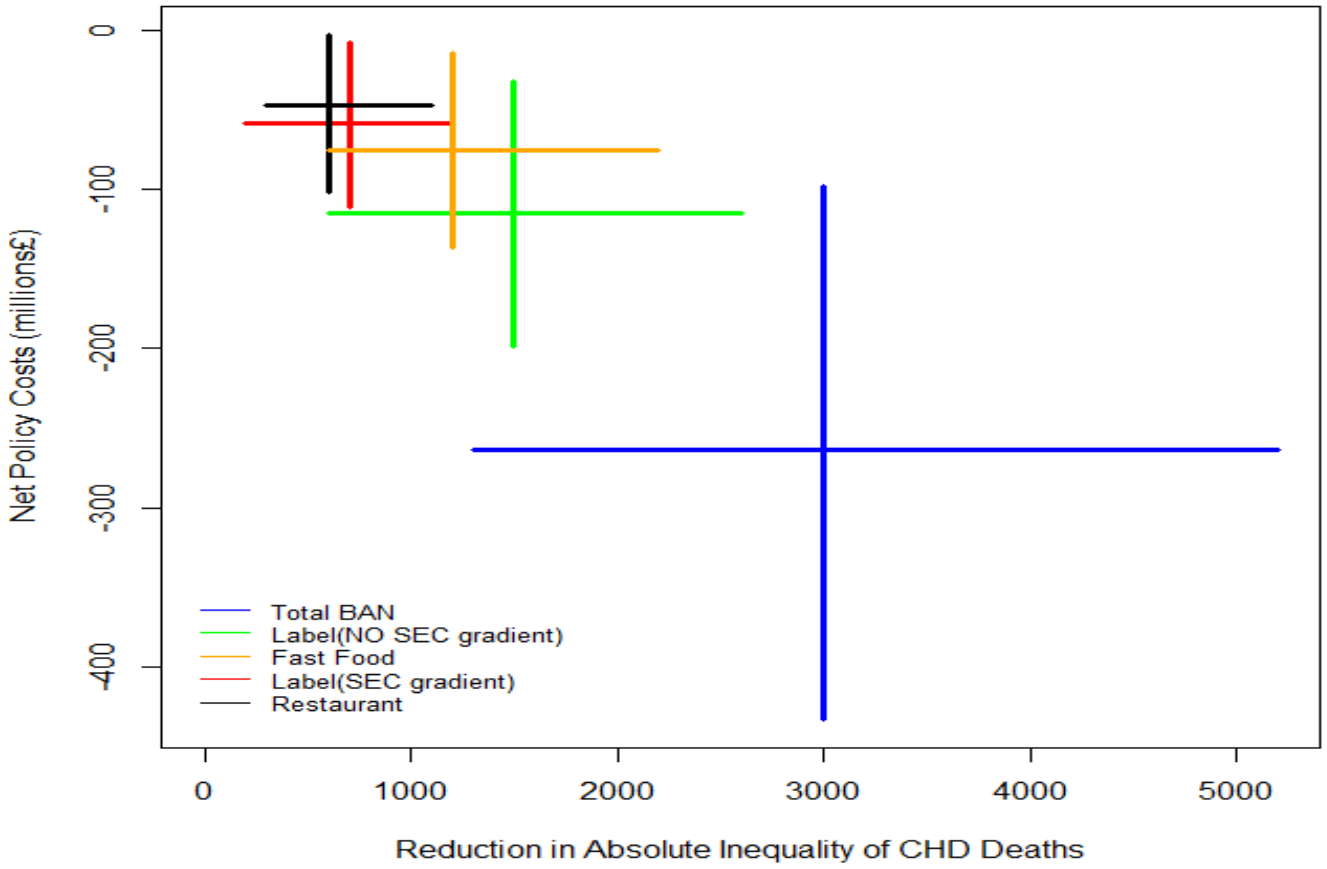
- Trans fats reduction
- Out of home calorie labelling
- Salt reduction
- Calorie reduction
- Fruit and vegetables
- Front of pack labelling
- Saturated fat reduction

RD Evaluation

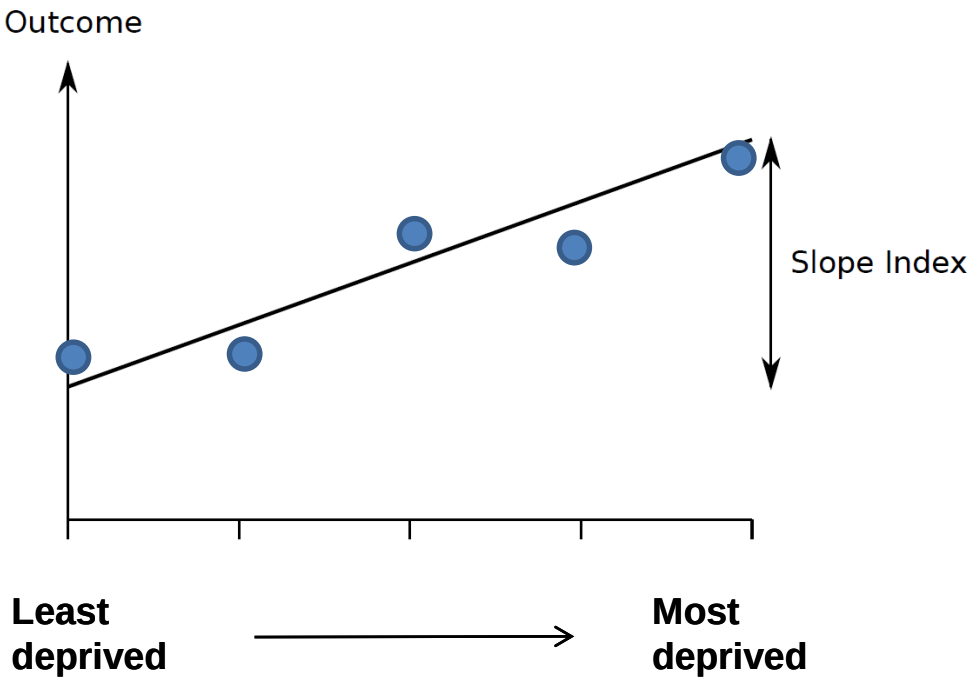
- ‘pledges could be effective if fully implemented’
- ‘most effective strategies... Food pricing strategies, restrictions on marketing... Not reflected in RD food pledges’
- Most interventions clearly (37%) or possibly (37%) underway regardless of RD
- Analysis of trans fats pledge ongoing

Knai et al, Food Policy 2015

Net Costs with no Industry costs



Socio-economic differentials in outcomes



Index of Multiple Deprivation (IMD)

- Defined at Lower-layer Super Output Area (LSOA) for England
  - 32,482 LSOA in total
  - Average population approx 1,500 per LSOA

	Domain Weight
Income Deprivation	22.5%
Employment Deprivation	22.5%
Health Deprivation and Disability	13.5%
Education, Skills and Training Deprivation	13.5%
Barriers to Housing and Services	9.3%
Crime	9.3%
Living Environment Deprivation	9.3%

Sensitivity analysis input parameters

MODEL PARAMETER	SENSITIVITY ANALYSIS
TFA consumption	Normal distribution with assumed standard error of 10% of IMDQ-specific value (e.g., 1.2% ± 0.12%)
TFA link to CHD mortality	Normal distribution of meta-analysis coefficient (23% with 95%CI 11% - 37%)
Labelling response gradient	PERT distribution with mean 50%, min 20% and max 105% [20]
CHD mortality counterfactual	Normal distribution of the *logit* of the predicted rates based on upper and lower confidence intervals from model output [3]
CHD patient numbers (incidence)	Annual percent decline in patient numbers could vary from -5% (an increase of 5%) to 10%. A Pert distribution was used with a best estimate of 5% decline